US009923300B2

(12) **United States Patent**
Marrs et al.

(10) **Patent No.: US 9,923,300 B2**
(45) **Date of Patent: Mar. 20, 2018**

(54) **SEMI-RIGID HIGH-VOLTAGE EXTENDER**

(71) Applicant: **MARSHALL ELECTRIC CORP.**, Rochester, IN (US)

(72) Inventors: **Thomas C. Marrs**, Rochester, IN (US); **Donald Recupido**, Argos, IN (US)

(73) Assignee: **MARSHALL ELECTRIC CORP.**, Rochester, IN (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/157,925**

(22) Filed: **May 18, 2016**

(65) **Prior Publication Data**

US 2017/0338589 A1 Nov. 23, 2017

(51) **Int. Cl.**

H01R 13/44	(2006.01)
H01R 13/53	(2006.01)
H01R 33/02	(2006.01)
H01R 33/965	(2006.01)
H01R 13/631	(2006.01)

(52) **U.S. Cl.**

CPC ***H01R 13/53*** (2013.01); ***H01R 13/631*** (2013.01); ***H01R 33/02*** (2013.01); ***H01R 33/965*** (2013.01)

(58) **Field of Classification Search**

CPC H01R 13/53
USPC 439/125; 313/136, 143
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,076,113 A * 1/1963 Candelise ..... H01R 13/5219 174/77 S
4,514,712 A * 4/1985 McDougal ..... H01F 38/12 123/169 PA
4,944,259 A 7/1990 Richardson
5,060,624 A * 10/1991 Bruning ..... F02F 1/242 123/169 PA
5,357,233 A * 10/1994 Wada H01F 38/12 123/634
5,577,921 A * 11/1996 Philyaw ..... H01T 13/04 123/169 PA
5,685,282 A * 11/1997 Murata ..... H01T 13/04 123/169 PA
5,716,223 A * 2/1998 Phillips, Jr. H01T 13/06 439/125
5,749,742 A * 5/1998 Bertuzzi, Jr. H01R 13/6276 439/125
6,068,495 A 5/2000 Virchow
6,340,303 B2 1/2002 Hamada et al.
6,467,447 B1 * 10/2002 Holmes ..... F02P 13/00 123/169 PA

(Continued)

Primary Examiner — Tulsidas C Patel
Assistant Examiner — Peter G Leigh
(74) *Attorney, Agent, or Firm* — Egbert Law Offices, PLLC

(57) **ABSTRACT**

An extender for connecting a high-voltage source to a spark plug has a conductive member, a tube having an interior passageway in which the conductive member is positioned therein, and a boot affixed over an exterior of the tube. The boot is formed of a material having a rigidity less than a rigidity of a material of the tube. The boot has a first end adapted to connect with the high-voltage source and a second end adapted to be connected to the spark plug such that the conductive member is in electrical connection with the spark plug and the high-voltage source. The conductive member includes a spring that is adapted to electrically connect with the high-voltage source and the spark plug.

17 Claims, 6 Drawing Sheets